ABSTRACT

An efficient computation of low-dimensional linear subspaces that optimally contain the set of images that are generated by varying the illumination impinging on the surface of a three-dimensional object for many different relative positions of that object and the viewing camera. The matrix elements of the spatial covariance matrix for an object are calculated for an arbitrary pre-determined distribution of illumination conditions. The maximum complexity is reduced for the model by approximating any pair of normal-vector and albedo from the set of all such pairs of albedo and normals with the centers of the clusters that are the result of the vector quantization of this set. For an object, a viewpoint-independent covariance matrix whose complexity is large, but practical, is constructed and diagonalized off-line. A viewpoint-dependent covariance matrix is computed from the viewpoint-independent diagonalization results and is diagonalized online in real time.